Ph.D. Qualifying Exam: Theory of Linear FEM

Department of Mechanical Engineering University of Utah

Exam Description:

This exam covers the fundamental theory and application of the linear static finite element methods for continuum mechanics. Students are expected to be able to:

- Describe the theory of the finite element method
- Write their own finite element code
- Analyze various physical problems using FEM
- Verify and Validate (V&V) obtained numerical solution
- List the limitations of the FEMs

Recommended References:

- A First Course in Finite Elements by J. Fish and T. Belytschko
- An Introduction to the Finite Element Method by J.N. Reddy
- The Finite Element Method by T.J.R. Hughes

Exam Materials:

No equation sheet will be provided. Students may bring a department issued calculator. No other materials will be allowed during the exam.

Topics:

Exam topics include:

- Formulation of finite element equations for one-dimensional problems:
  - Differential equation (strong form)
  - Integral or variational equation (weak form)
- Derive approximation functions and numerical integration
- Error and convergence in FEM
- Two-dimensional problems